Session Summaries and Next Steps

Northeast NMFS/Sea Grant Colloquium on Fish Habitat

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Colloquium on Fish Habitat

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INTRODUCTION

BACKGROUND

Habitats provide the basic needs of living things, including food, water, shelter, and space, throughout an organism's life cycle. Fish habitat is comprised of any aquatic ecosystem where the organism can live, either permanently or temporarily. A long-term threat to the viability of commercial and recreational fisheries is believed to relate to the continuing loss of marine, estuarine, and other aquatic habitats.

In amending the Magnuson-Stevens Fishery Conservation and Management Act, Congress has required that habitat considerations receive increased attention. Because Fishery Management Councils, in conjunction with the National Marine Fisheries Service (NMFS), must identify and map the essential fish habitats used by all life history stages of managed species, it is important to assess the function and value of these habitats–estuarine, coastal, and open water. Thus the development of sound, reliable habitat information is vital to the effective conservation, management, and scientific understanding of our fishery resources.

PURPOSE

The purpose of this Colloquium was to engage interested Northeast National Marine Fisheries Service staff and Sea Grant staff/researchers in discussions designed to identify common interests and goals in the area of essential fish habitat. For purposes of this Colloquium we used the NMFS definition of Northeast. This includes all of the Great Lakes states and states from Maine to Virginia on the eastern seaboard.

OBJECTIVES

- To identify appropriate research and/or outreach opportunities related to fish habitat on which Sea Grant and NMFS scientists and/or extension staff could collaborate.

- To identify research and/or outreach opportunities related to fish habitat that could become regional projects for the Northeast, Mid-Atlantic, and/or Great Lakes Sea Grant programs.

FORMAT

The Colloquium enlisted scientific experts from various institutions and organizations to review the state of our knowledge for each major topic area. We then had discussions about information needs and how we could build collaborations to meet these needs. The ultimate outcome was to develop agreed upon strategies for future critical fish habitat research and extension projects that Sea Grant and NMFS could collaborate on.

Impacts of Fishing Gear on Habitat

Kathy Castro
URI Sea Grant College Program

Panelists:

- Mike Pentony - New England Fisheries Management Council
- Peter Auster - National Undersea Research Center
- Jay Hermson - University of Rhode Island
- Joseph DeAlteris - University of Rhode Island
- Martin Posey - University of North Carolina, Wilmington
- Arnie Carr - Massachusetts Division of Marine Fisheries
- Craig Pendleton - Northwest Atlantic Marine Alliance

The objectives of the session as defined by the organizing committee were to enhance collaborative efforts between NMFS and Sea Grant and Regional Sea Grant Programs. More specifically, the following issues were addressed:

- To identify appropriate research and or outreach opportunities related to fish habitat on which Sea Grant and NMFS scientists and or extension staff could collaborate.

- To identify research and outreach opportunities related to fish habitat that could become regional projects to the Northeast, Mid-Atlantic and or Great Lakes Sea Grant Programs.

In order to initiate these discussions with the audience, a seven-member panel was invited to speak for 10 minutes each. The purpose of the panel was to succinctly identify and address the important issues, describe progress to date in ecological research, modeling and gear engineering.

The hour-long discussion that followed was not an attempt to reach consensus, but rather an opportunity to engage all participants in the identification of issues and projects that were important to them. The notes were reviewed and compiled.

ISSUES AND PROBLEMS IDENTIFIED

1. Habitat management vs. fisheries management
    a. How can we balance the needs of both?

2. Understanding the *value* of habitat. Need for a common language and a common currency.
    a. economic value
    b. social value

c. ecological value

3. Difficulties with research

a. Statistical power is expensive but critical to confidence in results. Use of sentinel or experimental sites may reduce costs, however how results are scaled up is sensitive to experimental design. What is the proper scale to do research?

b. Complications with natural variability and change.

4. As in other fisheries issues, there are many sides to the story. All stakeholders are equally important. It is important that facts are not taken out of context. A lot of information taken out of context can do a lot of damage. All players need information but how information is interpreted is critical.

5. *Effect* and *Impact* are two different measurements. What is the currency?

6. How do you make up a blueprint for collaboration? Most of the on-going projects are "bottom-up" collaboratives, not top-down. Depend primarily on personal relationships and connections, sometimes just being in the right place at the right time.

IDENTIFICATION OF JOINT NMFS/SEA GRANT RESEARCH PROJECTS

1. The closure areas are "experiments waiting to happen". There are identified priority areas of research identified by the NEFMC. However this will happen quickly. Is there money available within Sea Grant programs/NMFS that can be accessed?

2. The gear engineering work has produced video data on gear/bottom interactions. Is there a way to standardize this to describe the effects? We need to start looking at specific gears in specific habitats. Appropriate technologies need to be defined and developed. This will require ecologists, gear engineers and fishermen working together. The disaster fund provides opportunities for fishermen to be involved in research projects.

3. Behavior studies in lab settings are useful in understanding processes, i.e. value of eelgrass as haven for silversides and stripers from bluefish predators. These can help understand fisheries interactions.

ACTION ITEMS:

There were 2 action items discussed regarding fishing gear and habitat:

a. 1-2 day workshop on gear and habitat interactions similar to the gear conservation engineering workshop held in RI 10 years ago. Bring European

researcher (Kaiser or Ramsey) to speak about methodology and results of their research. Form an ad hoc group of people interested in this type of work that can collaborate in the future.

b. Sea Grant Extension project. Meet to refine and discuss new information.

The Impact of Aquaculture on Fish Habitats

Cliff Goudey

MIT Sea Grant College Program

Panelists:

- Harald Rosenthal, Univeristy of Kiel, Germany
- Kenneth L. Beal, NMFS, Northeast Region

Harald Rosenthal, University of Kiel, Germany

Science and the Environment

What is needed to manage the coastal zone properly? A multi-use concept: where the multiplicity of uses provides a hedge against failure of any one use of a resource and enables flexibility in face of unexpected change, i.e. - the market place or natural variation in the productivity of the resource.

When modeling and monitoring complex systems, we should aim at improved predictability, strive for sustainability in areas of uncertainty. We need a way to filter the complex variety of model results into a clear and informative report that managers can incorporate in the decision-making process.

Ecological damage is only part of the risks associated with coastal pollution, so information from ecological models has to be integrated in a context of economic and social factors. The output of a set of complex ecological models is more than even the most skilled and dedicated environmental manager can incorporate in the decision-making process. Ecological models are becoming too complex and sophisticated to be understood and used effectively by non-scientists. Indeed, most problems require several models to assess fully the potential risks. Fuzzy logic can be used, i.e. Sim-Coast. This method can be effective in scenario building, and used like an expert system. In this way we can use artificial ecologies to test hypotheses.

Your approach to these problems depends on your philosophy of science: positivism, determinism, relativism, realism. The role of natural sciences is to identify the possible. The role of social science is to identify the desirable. Under a reactive process, tension exists and is often promoted by NGOs to impose pressure on decision makers. A proactive approach is needed. We need to improve communication between science and public. Education is needed at all levels - politicians and journalists in particular. Dr. Rosenthal presented an extensive overview on the topic. Among the issues covered were:

Aquaculture Systems & Production Trends

Impact of coastal aquaculture on the environment
Mitigating / minimizing environmental impacts
- **reducing nutrient outputs**
- **reducing the use of anti-microbials**
- **appropriate site selection criteria**
- **simulation models to predict impact**
- **new mitigation strategies**
- **site rotation**
- **feed optimization**
- **improved husbandry**
- **year class separation**
- **prophylactic measures (e.g. vaccination, genetics))**

Land-based versus water-based systems
- **nutrient loading (hypernutrification or eutrophication)**
- **organic load/suspended solids/biodiversity**
- **benthic impact of coastal cage farming**
- **the use of anti-microbials and their impact**
- **interaction of aquaculture with wildlife**
- **disease transfer and disease control**
- **impact of aquaculture on aquaculture**

Kenneth L. Beal, NMFS, Northeast Region, Gloucester, MA

The Impact of Marine Aquaculture on Fish Habitats

Aquaculture, like agriculture, changes habitats. Aquaculture development should be habitat-driven, since good habitat is imperative for sustainable, environmentally sound aquaculture operations. Some of the factors which must be addressed in any site would include water and sediment quality, particularly organic and nutrient wastes and enrichment, decomposition of feed and organic wastes, potential eutrophication, hypoxia, algal blooms, turbidity, disease control medications, fish respiration, sedimentation, changes in water and sediment chemistry, facility discharges, spills, impacts of construction or facility maintenance, physical alterations to the environment in the vicinity of the facility. There is also concern about loss of genetic diversity, escapees, introduction of non-indigenous species, contagious diseases and food web changes. There are concerns about the impacts of aquaculture on the habitat of protected species such as whales, turtles and birds, all of which may become entangled in the gear. Some of the impacts, though, may be sublethal, such as the disruption of feeding, mating, nursery areas, resting, migration, communication and other social interactions.

Aquaculture research conducted in the Northeast Region of NMFS through the Saltonstall-Kennedy (S-K) grant program and the Fishing Industry Grant (FIG) program from FY 1994 to present has totaled over $6.7 million and supported 39 projects. In addition, two projects totaling $0.6 million have been funded through other programs during this period, giving a total of 41 projects valued at $7.3 million. This work is in addition to that conducted at the NMFS aquaculture research laboratory in Milford, CT. A collection of project summaries, based on the original scope of work for each of the 41 projects, and final results of completed projects are available.

One of the S-K projects sampled in 3 locations in coastal Maine. A key conclusion was that short-term sampling would have given misleading results in the site which had the lowest current flow, as wind-driven currents in the fall and winter dispersed the accumulations seen during the rest of the year. In this study, the predicted rates of organic carbon flux were two to ten times greater than observed, and it was concluded that the particulate wastes originating from within the pens were rather quickly degraded and dispersed. The researchers concluded that sampling at any site should not be of a short duration, and several years would be best to achieve dependable results. Furthermore, in areas with adequate space between sites and with strong currents to provide good flushing, there actually appears to be a biostimulation of bottom-dwelling species.

Microbial decomposition of organic-rich wastes consumes oxygen, and if the waste accumulation is extensive, this situation can lead to anoxia and to the generation of methane and hydrogen-sulfide gases. Observations in Japan and Europe where the aquaculture operations are in shallow water or in locations where these facilities are dense and extensive have produced anoxia. However, this condition is reversible by practices similar to those used in farming, i.e., leaving an area fallow for a while, rotating crops, and "harrowing" the bottom.

A variety of chemicals have been used in aquaculture to deal with pests, fouling organisms, parasites and diseases, as well as predators. Antibiotics and vitamins as feed additives are typical, and in some cases, chemicals are simply broadcast through the water. Antibiotics are used in shrimp and finfish culture, and this practice raises the risk of persistence in the environment, and of developing strains which are not affected by the antibiotics. Fortunately, some studies have indicated that antibiotic- resistant strains of bacteria may be as short-lived as nine days. The use of antibiotics has declined due to the development of effective, inexpensive vaccines. In 1994, Norway reported a 73% decline in the use of antibiotics in salmonid culture, and salmon farmers in the US reported similar declines. Management techniques such as maintaining a proper distance between sites, avoiding overlap of generations on farms, and allowing regular fallow periods all help to avoid these problems.

One area of potential impact which has generated intense debate is the possibility of impacts on wild stocks resulting from inadvertent escapes of cultured animals. The

rationale for this concern ranges from the transfer of disease from cultured species to wild stocks, to changes in the gene pool of wild animals through cross-breeding, and competition between wild and cultured species for food, habitat, or other environmental requirements. Thousands of salmon from net-pens in Norway have been lost during the past 10 years; however, it has been reported that no genetic impacts have been reported from these losses. Techniques to reduce the potential for adverse impacts include using local broodstock for hatchery operations, stocking cultured offspring in the location the broodstock came from, increasing numbers in broodstock pool to keep genetic variability high, or culturing sterile finfish.

In conclusion, impacts on fish habitat from aquaculture operations vary depending on a number of considerations, with dispersion by currents being one of the most important site-related factors. That is, degraded water quality is much more common in sites where currents are weak than in sites with strong currents. However, other factors enter the equation, and there are several techniques which the grower can use to minimize adverse impacts. The bottom line is that research concerning site-specific correlations should not be done over a short time-frame, as some sites experience natural events which negate some or all of those adverse impacts. Although non-local research findings should be of interest, we must also be careful not to blindly adopt those findings without determining if conditions are the same in our own back yard. In short, we need to do more research, especially site-specific habitat studies.

Potential Research Topics on the Impact of Marine Aquaculture on Fish Habitat:

- Improved models for predicting ecological damage
- Ecological models based on fuzzy logic
- Improved communication between science and public
- Aquaculture education aimed at politicians and journalists
- Ballast water and the mariculture industry
- Combined shellfish (long-line) and seaweed culture
- Assessment of artificial habitats for juvenile fish (artificial reefs)
- Reef structures to prevent trawling in nursery areas
- Feasibility of sewage fed fish ponds
- Assessment of plowing the grounds to introduce oxygen into the sediments, "harrowing" the bottom
- Mobile gear as a tool for conditioning the bottom
- Progress towards improved FCRs
- Biodiversity studies under aquaculture sites
- Development of guidelines for chemical use in aquaculture
- Models to predict assimilative capacity of a site
- Improved hardware for open ocean fish farming

- Development of management techniques
- Long-term studies of sites and the relevance of natural events

Role of Estuaries in Sustaining Coastal Fisheries

Mark Malchoff
NY Sea Grant College Program

Panelists:

- Jeffrey Cross, James Howard Laboratory, NMFS
- Michael Weinstein, NJ Sea Grant

Jeff Cross, NMFS James Howard Lab, Highlands, NJ

Remarks focused on:

1. How has EFH impacted NMFS activities?
2. Overview and Implementation of EFH by NMFS

EFH definition – "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity." This language has big impact - 39 plans, over 600 species.

NMFS developed regulations and guidelines for designating EFH
NMFS also developed information and recommendations to identify EFH

The 9 regional fisheries management councils amended fishery management plans to identify and describe EFH and threats to EFH, recommend conservation measures, and minimize adverse effects from fishing.

For actions that may adversely affect EFH, NMFS provided conservation recommendations to federal and state agencies. EFH Classification system discussed.

Tier	Data	EFH
1	presence/absence	habitats most commonly used
2	quantitative distribution	habitats with moderate to high abundance
3	life history rates	habitats with highest survival, growth, and repro rates
4	production rates	habitats that support objectives of a fishery management plan
1	no data	

In New England, 18 species x 5 life history stages = matrix of 90 cells, 11% of cells are blank and 87% of cells are tier 1 and/or tier 2 data.

Data sources used by NMFS in communications to Councils:

1) NMFS groundfish surveys

2) MARMAP surveys – bongo tows
3) State surveys

How did NEFMC use the data? The data were initially sorted into "bins" consisting of 10 minute squares. The catch per unit effort (CPUE) was estimated for each square. Then the scientists graphed percent occurrence by mean CPUE, with the assumption that higher abundances were indicative of favorable habitats. As population levels change, should see contraction/expansion in ranges for each species. Cod example shown graphically (1979-83 vs. 1984-98). Range shrunk.

Examples from Long Island Sound were also discussed. Used state fishery independent surveys from Maine to North Carolina. There are a lot of problems with these surveys, but Council and NMFS staff are trying to do 6-8 (out of 20 or 30) of these data sets. Recommendation was to use the ELMER "data" which is really data mixed with best professional judgement, hence councils were left with tough choices. Atlantic Cod example. EFH for cod eggs shown graphically. The figure depicted Georges Bank and mid-shelf Gulf of Maine. Larvae were more widespread than were other life stages. Council also used other than NMFS data, including fisherman stuff. Habitat area of particular concern (HAPC) for cod was also discussed. HAPC includes parts of Closed Area I and Closed Area II. There are currently no management implications for these areas, but the designation just says its important (i.e. higher survival of juveniles in cobble). This seems to be an example of Tier 3 data.

EFH in 1999 and Beyond - Identification of Potential Joint Projects

- Need to refine EFH designation
- Need to study effects of fishing gear and fishing activities on EFH
- Need to investigate effect of non-fishing activities on EFH
- Develop methods to conserve and enhance habitat productivity
- Conduct outreach programs for stake holders

The take home point seems to be that importance of EFH will grow as more agencies utilize the information and the information gets better (e.g. move up the tier scale).

How Can EFH Data be Refined and Improved

- Gather information on distribution and abundance of poorly known life history stages
- Characterizations of shelf habitats
- Investigate functional relations between species and their habitats.

Jeff provided a brief discussion of estuarine dependence - 70% of landings are from species estuarine dependant (not species, landings). Also provided an example of a tier

0 situation involving an economically important species. Apparently there are few data about presence of scup (porgy) eggs in the Mid-Atlantic Bight. Those data that do exist are now about 25 years old! Jeff indicated that if any one has a student that needs a master's thesis, this is an important issue. Dr. Cross also reviewed a situation in Delaware Bay, in which investigators have been able to map a previously unrecognized sandbar shark pupping area. Bluefish and striped bass habitat overlap question was also addressed. YOY striped bass move into sections of the Hudson Estuary at age 1+. Bluefish coming in from offshore also use these environments. Schoener's overlap index analysis shows little overlap in early summer, but come October significant overlap. In this case, the presence of eelgrass serves to mediate predation. In non-vegetated habitats, bluefish exhibited a high selectivity for stripers. Again, this served as an example of the "kind of data we need." Jeff also reviewed benthic habitat analysis in the form of sidescan printouts for New York Bight apex. Among the prominent features yet to be fully studied are 10 kilometer long underwater dune formations south of Long Island, which clearly appear in the sidescans.

How are fish using these habitats:

Dr. Cross displayed a graphic illustrating winter flounder YOY (<20mm) presence/absence predictions based on narrow range of temperature/salinity in sediments with high organic matter. Major Point = habitat can be dynamic, and may include water column characteristics, not just benthic stuff. Along these lines he also talked about salmon redds and smolts (juveniles) in streams. The data seem to suggest that it is "best" to have spawning habitats adjacent to smolt habitat.

Discussion:

Discussion centered around the difficulty of obtaining tier 3 or 4 data. There was interest in how NMFS planned to account for the impacts of fishing gear, as well as other human activities on EFH. Council and NMFS representatives indicated they would continue to review coastal development activities, taking a precautionary approach, but it may be site specific which may force more caution. It was first thought best to put burden of proof on the industry, but commercial magnitude, history and economics preclude this. Other questions/comments were also posed related to the use of the 10 minute grids, and a reinforcement that habitat may include other than benthic data, and may be ephemeral.

Dr. Mike Weinstein, NJ Sea Grant Director
Saltmarsh, Estuaries and EFH

Marine transients – adults live offshore, part of life history in estuary. Cape Fear River study in 1970's. Larval abundance and size function of timing and streamflow? Major

discussion point – the head of estuary near top of salinity maximum zone is an important region (i.e. EFH). Second point - Deepwater at head of estuary is important for croaker and maybe spot. Spatial and temporal scales are important. No croaker in marsh in February 1977 – corresponds to severe winters in Northeast, but deepwater nearby may represent refugia during abnormal weather conditions. Also – EFH is dynamic, expands and contracts as per Jeff Cross. Important to pay attentions to scale. Also saw resource partitioning by salinity gradient (summer flounder and southern flounder?). Saw site fidelity in oligo-mesohaline zone. At mesohaline site did mark-recapture study of spot with radioactive dye. Decay rate probably is proxy for emigration of spot. Allowed for calculation of production (cal/m2). Discriminate analyses revealed that diversity is higher in marshes than in the creeks w/grass beds. Also saw differences between Ruppia vs. Zostera habitats.

Salt Marsh Symposium Proceedings
Mike reviewed the writings of Teal (1962) and Odum (1968), along with those of Haines (1979). Perhaps vision of salt marshes as great estuarine engines may not be valid? Marsh estuarine interactions are much more complex than previously recognized. Migration of marine transient species is definitely playing a role. A take home point seems to be that the natural function of the salt marsh is thus tied not only to primary production on the marsh plane but also to a well developed dendritic pattern of the tidal creeks (Weinstein et al., 1997).

Marsh Ecology Research Program. Links between marsh production and fish production could use more research, but it should be noted that some folks have been asking questions related to tier 3 and tier 4 data (see Jeff Cross talk above) in salt marshes since late 70's. Now Congress is in the act – maybe additional monies will be made available. Dr. Weinstein also reviewed an S-K funded project looking at anchovy diets sourced from particulate organic matter (POM), spartina, and benthic microalgae via stable isotope analysis.

Dr. Weinstein also reviewed more current research investigating links between weakfish life history and interactions between this species and estuarine habitats.

Questions:

- Where was the animal in the past year?
- Did it spend more time in some habitats than others?
- Which habits are "more essential," if any? One of the techniques that investigators can use to get a handle on these questions is that of stable isotope analysis.

Dr. Weinstein's last talk reviewed marsh restoration efforts at a Delaware Bay site (Mad Horse Creek). Discussion – now we can say that phragmites is finding its way into food

chain. The next question is, so what, is it important? There are a lot of parallels between EFH and Habitat Restoration program. MERP will soon be taken over by NJ Sea Grant. It's a $300K program that could be leveraged with NMFS and SG dollars to generate multi-year, multi-investigator efforts. An important question is how do we define habitat and how do we define restored habitat? Let's cooperate with NMFS/SG to work on this because human activity in these environments is large, pervasive and unlikely to decline in terms of its importance. The last comment was that we have learned a lot about the role of MAB marshes. These findings may not apply to estuarine systems in New England.

Physical and Chemical Alteration of Fish Habitat

C. Dianne Stephan
Northeast Region, National Marine Fisheries Service

Panelists:

- Moe Nelson, National Ocean Service NOAA
- Paul Baumann, Ohio State University
- Peter Colosi, NE NMFS

The most pressing questions regarding physical or chemical alteration of fish habitat revolve around the determination of thresholds beyond which impacts will have unmitigatable effects. What is the extent to which we should limit development or other anthropogenic activities in order to provide for the perpetuation of healthy living marine resources? Coastal habitat managers grapple with these quandaries everyday as they attempt to mitigate (avoid, minimize or compensate for) adverse impacts to living marine resources and their habitats. Research has provided the basis for development of many best management practices; however, confounding factors such as variable habitat and species distributions, and the unresolved mysteries of the ecosystem result in decisions which are too frequently subjective in nature. The dire need for information and opportunity for immediate application in habitat management highlight this as a topic area in need of regional collaborative efforts.

The presentations in this session of the colloquium reviewed a number of research and management efforts in the area of evaluating chemical or physical impacts to habitat and associated living marine resources. Dr. Paul Baumann of the U.S. Geological Survey and Ohio State University presented a study that investigated the acute and chronic effects of toxic discharges and disturbance of toxic sediments on the resident bullhead population of a mid-western river. Mr. Moe Nelson of the National Ocean Service outlined a number of projects at various stages of completion which evaluate habitat suitability for marine or estuarine species. Mr. Dale Leavitt of the Woods Hole Oceanographic Institute Sea Grant Program made an ad-hoc presentation on determination of impacts of a new dredged material disposal site on lobsters and lobster habitat. And finally, Mr. Pete Colosi, Chief of the Habitat Conservation Division, Northeast Regional Office of the National Marine Fisheries Service (NMFS), reviewed the mission and activities of his division, which included a discussion of responsibilities under the essential fish habitat (EFH) mandate, and highlighted information needs and areas of collaborative opportunity. A brief discussion period followed the presentations. Each of these presentations is summarized in more detail below.

Dr. Baumann reported his research on cancer and reproductive dysfunction found in brown bullhead of Ohio's Black River. These physiologic anomalies were caused by steel industry coking discharges which included PAHs and other biotoxins. Although the study took place in a freshwater environment, analogous studies have

been conducted at the NMFS Northwest Fisheries Science Center under the direction of Dr. Usha Varanasi. Similar scenarios of toxic effects on fish have also been found in the Ashtabula River, Cuyahoga River, and other rivers of western New York State and Ohio.

PAHs were found to accumulate in riverine sediments, and were introduced to bullheads via feeding and physical contact. Since PAHs are metabolized by vertebrates, they do not tend to bio-accumulate in the same way as some other toxins. Dr. Baumann pointed out that the U.S. Environmental Protection Agency (EPA) manages toxins using bioaccumulation factors, which is inappropriate in this circumstance.

Dr. Baumann's results showed that liver tumor incidence in bullheads decreased significantly by 1987; four years after the coking plant closed. In early 1990, the Black River was dredged, which removed much of the toxic sediment, but also re-suspended PAHs. In 1992-93, incidence of liver tumors increased to a level similar to that of the late 1980s. Tumor incidence decreased drastically after 1994, when the first year class produced subsequent to dredging was recruited into the sampling program.

Dr. Baumann concluded that a number of best management practices could be inferred from this study. First, he emphasized the need for communication with stakeholders about the potential for decreased environmental quality during remediation efforts. Second, he noted that use of dredging equipment more suitably designed for removal of toxic sediments would be preferable to the "clam dredge" used in this study. In closing, Dr. Baumann noted that the economics of the region was shifting to include recreational activities on the Black River, which would have been unheard of just 20 years prior.

Mr. Nelson recounted three studies developed by the NOS Biogeography Program to determine the association between estuarine and marine species and their habitats. This information is being developed to assist managers in determining the relative value of managed species' habitats for application in coastal management decision-making. In a study that investigated habitat affinities of estuarine fish in mid-Atlantic estuaries, EMAP data obtained from the EPA were analyzed to define fish distribution based on environmental parameters such as salinity and bottom type. One of the values of the EMAP database is that it is collected in a uniform format on a national basis. Polluted sites were identified by oxygen content and toxicity, as indicated by amphipod mortality, and removed from the analysis. A similar study was undertaken for the South Atlantic estuarine species, which included the development of habitat affinities for degraded sites. Results showed that habitat affinities were less clear for degraded versus pristine sites.

The third study is under development, and will apply these techniques to the nearshore coastal waters of Delaware. Coastal managers in this region are in search of information to assist them in determining the best locations for beach nourishment sand mining. The results of this study may be applicable along much of the Atlantic seaboard, since the issue of beach nourishment is a common one for coastal managers. Study results may also be used by decision-makers to assess or direct the impacts of

other coastal projects or activities such as fishing, dredging, or dredge material disposal.

Mr. Nelson also described the use of Estuarine Living Marine Resources (ELMR) data by the New England and Mid-Atlantic Fishery Management Councils in the identification and designation of EFH. The Councils used the ELMR data, which are available for all managed species and most Atlantic estuaries, to designate EFH based on species relative abundance and distribution.

Mr. Leavitt presented a short summary of the results of a project to mitigate the impacts of dredged material disposal on lobster habitat. The study area was a trough approximately three miles off Arundel, Maine which was proposed by the U.S. Army Corps of Engineers for use as a dredged material disposal site. A joint research effort used underwater photography to quantify the habitat available in the area. The quality of different habitat types for lobster was summarized from the literature, and applied to a GIS model of the habitat types that would be available after the trough was filled. Coastal managers found the area was only used by lobster as a migratory pathway, and that adverse impacts could be mitigated. Best management practices included limitation of dredged material disposal to times when lobsters were absent from the area.

In the final presentation of this session, Mr.Colosi reviewed the mission of the NMFS Habitat Conservation Division. Under the authorities of the Fish and Wildlife Coordination Act, Clean Water Act, Federal Power Act, Rivers and Harbors Act, Endangered Species Act, Marine Mammal Protection Act and Sanctuaries Act, the Division reviews federal projects which may have an adverse impact on marine, estuarine, or anadromous fish habitat. The Magnuson-Stevens Act has added to these authorities with requirements for the identification and protection of EFH.

Mr. Colosi pointed out that there is very little coastal habitat that has not been altered in some way. Common forms of physical alteration include shoreline stabilization, scour from boat moorings, docks, piers, dredging, fishing gear impacts and wetland fill. Examples of best management practices for these types of alterations were reviewed. Mr. Colosi described a recent impoundment project proposed for the development of waterfowl habitat which resulted in the flooding of black needlerush marsh, and loss of habitat for estuarine species. Better research information presented through public outreach could have helped to support the application of the recommended best management practices.

Finally, Mr. Colosi listed a number of coastal management research and outreach areas which would benefit from collaboration between NMFS and Sea Grant. These areas included the following: OUTREACH: education of the general public and federal agencies about best management practices in coastal development projects; coordination with fishermen regarding fishing gear impacts to habitat; MAPPING: greater resolution and improved delineation of EFH designations; FUNCTIONAL VALUE OF HABITATS: determination of quantity and quality needed for managed species; effectiveness of mitigation for coastal development projects.

The discussion portion of this session touched on a number of interesting topics. One participant described a recent conference in France about the ecosystem effects of fishing. One of the topics discussed at the conference which could be a great opportunity for international collaboration is the establishment of marine protected areas. A socio-economic question relative to this issue is the impact of marine protected areas (closed to fishermen) on fisherman behavior.

Atmospheric deposition of nitrogen and toxics was also discussed. Atmospheric deposition has been implicated as the major source of nitrogen in Chesapeake Bay. New Jersey is funding four projects reviewing this issue. Other organizations researching this issue include the NOAA cooperative institute at UNH and the University of North Carolina.

In summary, this session of the colloquium served to illustrate some of the technical areas which are opportune for NMFS and Sea Grant collaboration. NMFS' responsibilities in the arena of habitat protection require research to support the development and application of effective best management practices for coastal development projects. As noted in an earlier session, research on the relative impact of fishing gears is also needed in order to assist fishery management councils with understanding and mitigating for these impacts. Sea Grant's strengths in research and outreach could provide much needed scientific support and enhance public and fishing industry participation in resolution of these issues.

Next Steps: Action Items and Action People

Ann Bucklin
ME/NH Sea Grant

1. Impacts of Fishing Gear on Fish Habitat

Kathy Castro (RI Sea Grant) and Peter Auster (NENURC) will discuss appropriate next steps leading toward a regional proposal on this important topic. Possible next steps range from a workshop to tap into European efforts in this area, to a regional meeting to begin proposal preparation.

2. Marsh Ecology Program

Mike Weinstein (NJ Sea Grant) will continue development of this successful program. Mike will attempt to integrate other NOAA partners into this effort, which has had Sea Grant leadership to date.

3. Northeast NMFS/Sea Grant Extension Partnership Building meeting

Ken Beal (NMFS) and Rollie Barnaby (ME/NH Sea Grant) will lead the coordination of a two or three-day workshop to discuss, in practical terms, how NMFS and Sea Grant Extension can work together effectively.

4. Application of Existing Technologies to Studies of Fish Habitat

Cliff Goudey (MIT Sea Grant) will take the lead in convening a group to work toward assessment of appropriate technologies for fish habitat studies, including video, AUVs, and other tools and techniques currently available but not widely applied to these efforts.

5. Evaluation of Area II on Georges Bank

John Borman (NMFS) will identify a group of researchers and others to begin immediate evaluation of a proposal to re-open Area II on Georges Bank.

6. NMFS/Sea Grant National Coordination

Emory Anderson (NSGO) and Tom Bigford (NMFS) will lead efforts to ensure coordination between Sea Grant and NMFS efforts in fish habitat at the national level.

Additional efforts, some ancillary to those listed above:

A. Non-fishing impacts on coastal habitats

During the planning efforts listed above, more effort should be given to bringing two traditional Sea Grant priorities - water quality and non-point source pollution - into the research and outreach focus on fish habitat.

B. RFP Coordination

The RFP processes of the funding agencies and programs involved in fish habitat efforts should be coordinated, to allow and encourage joint funding. Directors and managers from Sea Grant, NMFS, and NURP - and other programs - should discuss how proposers may seek coordinated funding for fish habitat studies. Specifically, it would be highly desirable to have a joint Sea Grant / NMFS / NURP RFP in Fall, 1999, when the planned Sea Grant National Strategic Investment (NSI) funding becomes available.

C. Northeast SG Extension EFH Proposal

There was consensus that efforts to obtain immediate funding for the Northeast SG Extension proposal for a pilot project in EFH be continued, and that this initial effort be allowed to get off the ground as soon as possible.

D. Awareness of existing information on fish habitat

There are numerous sources of information on fish habitat issues, especially as they relate to the new regulatory environment surrounding EFH issues. All Colloquium partcipants were urged to obtain copies of the reports and proceedings of the many meetings and conferences on this topic during the past six months.

E. Stakeholders in Fish Habitat Issues

Future activities should include all stakeholders to the extent possible. A brief attempt to identify all stakeholders yielded the following list:

Federal

NOAA Programs and Offices:

Sea Grant College Program
National Marine Fisheries Service
National Undersea Research Program

National Ocean Service
National Estuarine Research Reserve Program (NERRS)
National Marine Sanctuary Program (NMSP)
Environmental Protection Agency - National Estuaries Program
US Fish and Wildlife Service

Northeast States

Department of Marine Fisheries; Department of Marine Resources; Division of Fish and Wildlife; etc.
Coastal Zone Management
Office of State Planning
Atlantic States Marine Fisheries Commission

Academic and Professional

American Fisheries Society (AFS)
American Society of Limnology and Oceanography (ASLO)
Estuarine Research Federation (ERF)
Society for Conservation Biology (SCB)
New England Estuarine Research Society (NEERS)
Atlantic Estuarine Research Society (AERS)

Commercial Fishing Industry

Fisheries Management Councils (New England, Mid-Atlantic)
Commercial Fishing Cooperatives, Auctions, and Associations
National Fisheries Institute
New England Fisheries Development Association

Other:

Port Authorities
"Coastal Coalitions"
Water Resources Development Act (WRDA)

Appendix A

NORTHEAST NMFS/SEA GRANT COLLOQUIUM ON FISH HABITAT

APRIL 7-9, 1999
Sheraton Harborside
Portsmouth, NH

AGENDA

Wednesday, April 7 - Harbor's Edge Room

1:00 - 1:30 PM - **Introductions and Welcome**

Brian Doyle, Colloquium Co-Chair, UNH/UM Sea Grant
Kenneth Beal, Colloquium Co-Chair, NMFS, NER

1:30 - 2:30PM - **Importance of Collaborations**

Ronald Baird, National Sea Grant College Program, Silver Spring, MD
Thomas J. Bigford, Habitat Conservation Division, NMFS, Silver Spring, MD

2:30 - 3:00PM - **BREAK**

3:00 - 5:00 PM - **Impacts of Fishing Gear on Fish Habitat**

Kathleen Castro, URI Sea Grant, Moderator
Roland Barnaby, UNH/UM Sea Grant, Recorder

Panelists

- Michael Pentony, NE Fishery Management Council
- Martin Posey, UNC Wilmington
- Jay Hermsen, URI
- Joseph De Alteris, URI Sea Grant
- H. Arnold Carr, MA Department of Marine Fisheries
- Craig Pendleton, Northwest Atlantic Marine Alliance/Fisherman
- Peter Auster, National Undersea Research Center, UCONN

6:30 - 7:30PM - **Social Hour - Harbor's Edge Room**

7:30PM - 9:30PM - **BANQUET - Harbor's Edge Room**

Dinner Speaker, Dr. David Meeker, UNH Department of Mathematics,
Climate Change: Fact or Fiction

Thursday, April 8 - **Langdon- Whipple Room**

8:15 - 10:30AM - **Impacts of Aquaculture on Fish Habitat**

Kenneth Beal, NE NMFS, Moderator
Clifford Goudey, MIT Sea Grant, Recorder

Panelists
- Harald Rosenthal, University of Kiev, Germany
- Kenneth L. Beal, NMFS, NER

10:30 - 10:50AM - **BREAK**

10:50 - NOON - **Role of Estuaries in Sustaining Coastal Fisheries**

Kenneth L. Beal, NMFS, NER, Moderator
Mark Malchoff, NY Sea Grant, Recorder

Panelists
- Michael Weinstein, NJ Sea Grant, Sandy Hook, NJ
- Jeffrey Cross, James Howard Laboratory, NMFS, Sandy Hook, NJ

NOON - 1:15PM - **BUFFET LUNCH - Roberts Room**

1:15 - 2:40PM - **The Role of Estuaries** (cont'd)

2:40 - 3:00PM - **BREAK**

3:00 - 5:15PM - **Physical and Chemical Alteration of Fish Habitat**

Joseph Farrell, Delaware Sea Grant, Moderator
Diane Stephan, NMFS, NER Recorder

Panelists
- Moe Nelson, National Ocean Survey, NOAA, Silver Spring, MD
- Paul Baumann, USGS BRD, Ohio State University
- Peter Colosi, NMFS, NER

EVENING FREE

Friday, April 9

8:15 - 9:00AM - **Building Strong Collaborations - Harbor's Edge Room**

- Emory Anderson, NMFS/National Sea Grant Office, Silver Spring, MD
- Ivar Babb, National Undersea Research Program/NOAA, UCONN

9:00 - 10:30AM - **The Role of Sea Grant Extension in Fish Habitat Issues**

- Brian Doyle, UNH/UM Sea Grant, Moderator
- Dana Morse, UNH/UM Sea Grant, Recorder

Panelists
- James Murray, National Sea Grant Office, Silver Spring, MD
- Clifford Goudey, MIT Sea Grant

10:30 - 10:50 - **Break**

10:50 - NOON - **Reports /Next Steps**

- Ann Bucklin, UNH/UM Sea Grant

NOON - **ADJOURN**

Appendix B

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